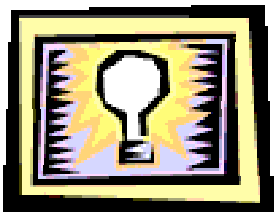
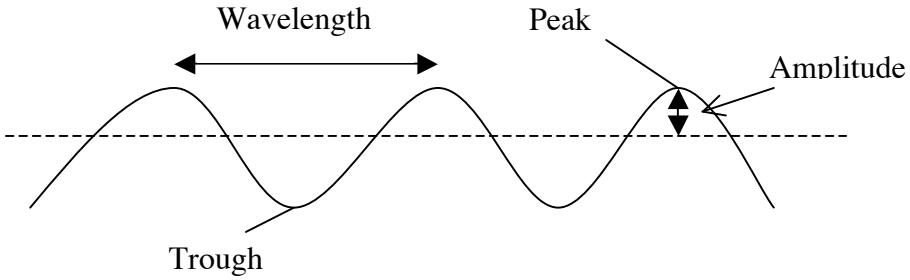
Science Background – Light 5.3



Light is a type of energy that travels in waves, similar to sound waves, but not the same as sound waves. Sound depends on molecules to travel. Light doesn't, but we still think of it as a type of wave. Here's a quick review of a wave model.



Light waves can have different wavelengths, which causes them to have different frequencies. (Frequency is a measure of how many wavelengths pass by a given spot in a second. The more wavelengths that pass by per second, the higher the frequency.)

So what?

Different frequencies (different sized wavelengths) create different kinds of light energy, such as different colors or even light that we can't see, such as **microwaves** and **x-rays**.

The Visible Spectrum

The visible spectrum is a range of light frequencies that we can see. People commonly remember the colors in order, from lowest to highest frequency with the name ROY G BIV. It stands for

RED ORANGE YELLOW GREEN BLUE INDIGO VIOLET

Light with a slightly lower frequency than red is called **infrared** and light with a slightly higher frequency than violet is called **ultraviolet**.

Reflection and Refraction

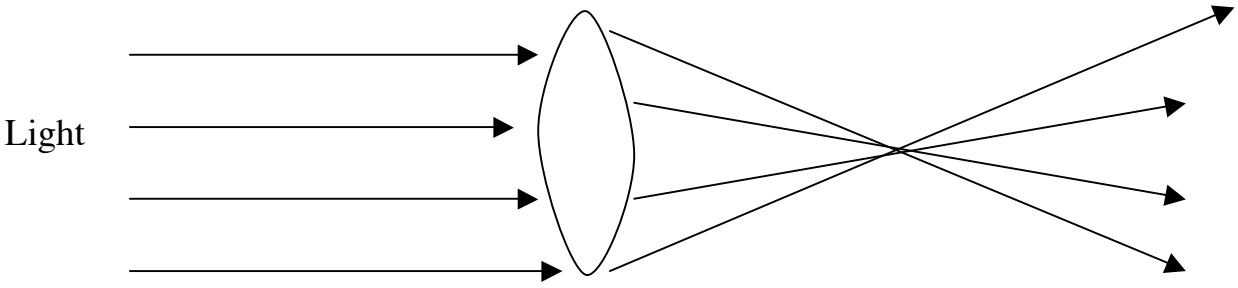
Like sound, light can bounce off of a surface that it strikes. If the surface is very smooth or shiny, it bounces back most of the light that hits it. This is called **reflection**. What you see in a mirror is light being bounced back to your eye.

When light passes through something, it changes direction slightly. The bending of light is called **refraction**. So let's bend some light –

Lenses

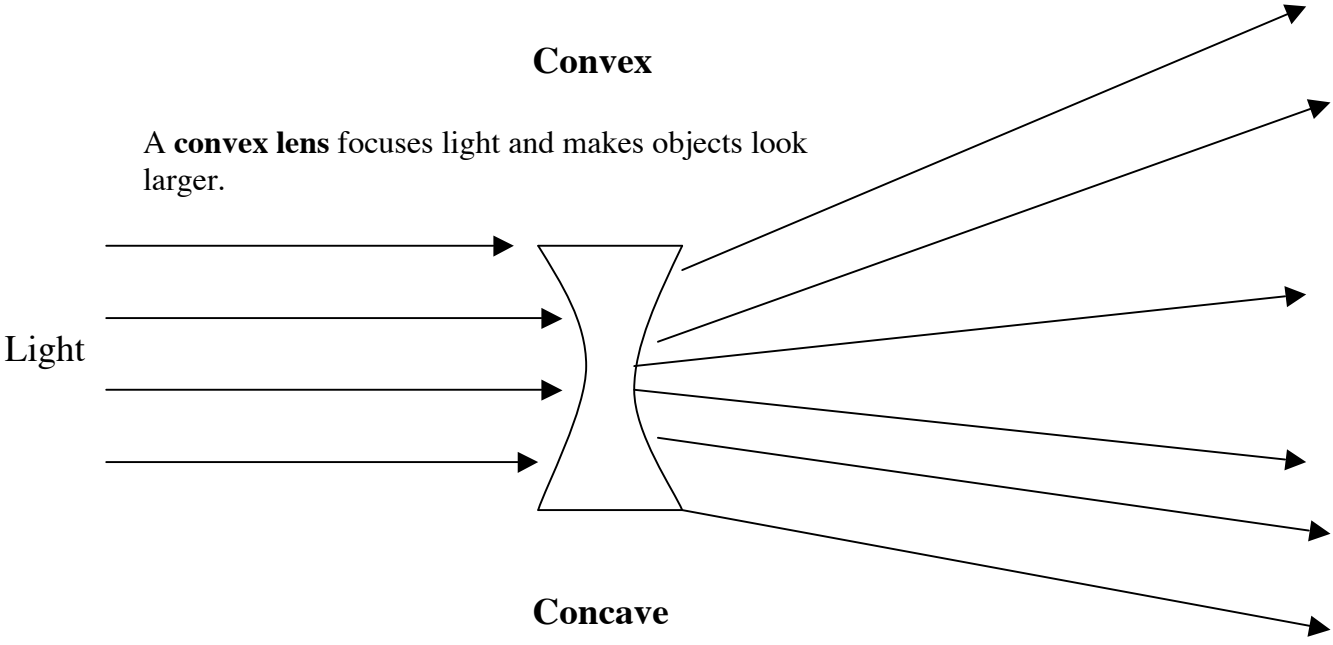
Hundreds of years ago, man started bending light to improve his ability to look at things. Scientists learned that by creating shaped glass lenses, they could make small or far away objects look bigger than they actually were. Today we still use lenses in our telescopes, microscopes, cameras and eyeglasses. Here's how they work.

There are two main types of lenses:



Convex

A **convex lens** focuses light and makes objects look larger.



Concave

A concave lens makes light rays spread out. This type of lens makes object look smaller.

Transparent, Translucent and Opaque

We have three ways of describing how light behaves when it meets an object.

Transparent objects are clear. Most light shines through them. Windows and glasses are examples of transparent objects.

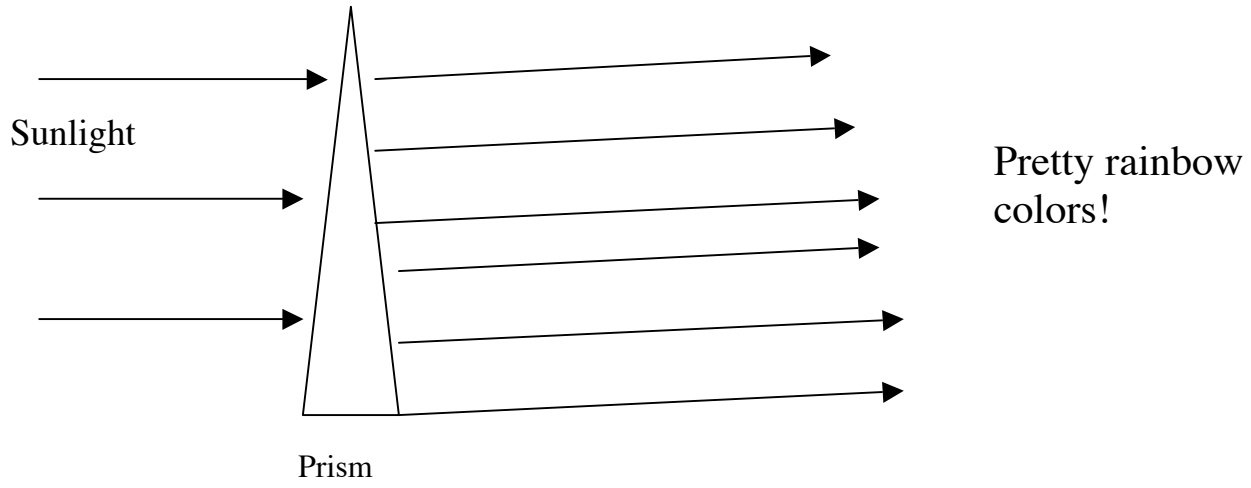
Translucent objects are cloudy. Some light passes through them, but you can't really see through them. Examples of translucent objects are thin paper or cloth or stained glass like you might see at a church.

Opaque objects don't let light go through them. A brick is an opaque object.

Rainbows and Prisms

When all of the colors of the visible spectrum hit our eyes, we see white light. When white light hits an angular transparent object, the light frequencies are split apart into the colors of the spectrum. When you see a rainbow, you're seeing sunlight, which has all kinds of frequencies, getting separated into its parts by groups of raindrops.

A prism is an angular piece of glass. Here's a diagram:



Great Scientists and Light

Galileo Galilei – 1500's and 1600's - Developed a telescope to look at objects in space. Tried to measure the speed of light, but it was too fast for him to measure.

Robert Hooke – 1600's – He built a refracting telescope and used a microscope to study cells.

Anton van Leeuwenhoek – 1600's – He built microscopes and identified lots of tiny animals.

Isaac Newton – 1600's and 1700's - He discovered the visible spectrum ROYGBIV in white light. He also developed theories to explain colors.

Speaking of Colors…

When we see colors, we see parts of the spectrum that reach our eyes. When you see a red sweater, you see red because the sweater is absorbing some of the frequencies and reflecting the ones that make red. Black objects absorb all of the visible frequencies, so our eyes see no color - we see black. That's why black objects get so hot in the sun – they absorb most of the sun's light energy.